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Network Models of Minority Opinion Spreading: A Computational Approach for Studying Possible Scenarios of Complex Social Contagion on Vaccination Behaviour

Javier Álvarez-Gálvez, PhD

Department of Biomedicine, Biotechnology and Public Health

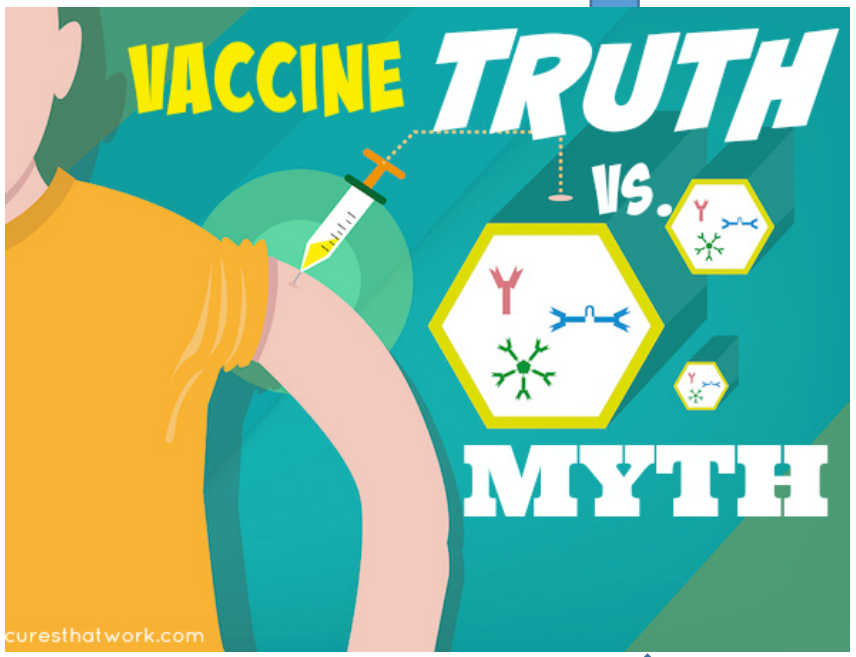
University of Cadiz (Spain)

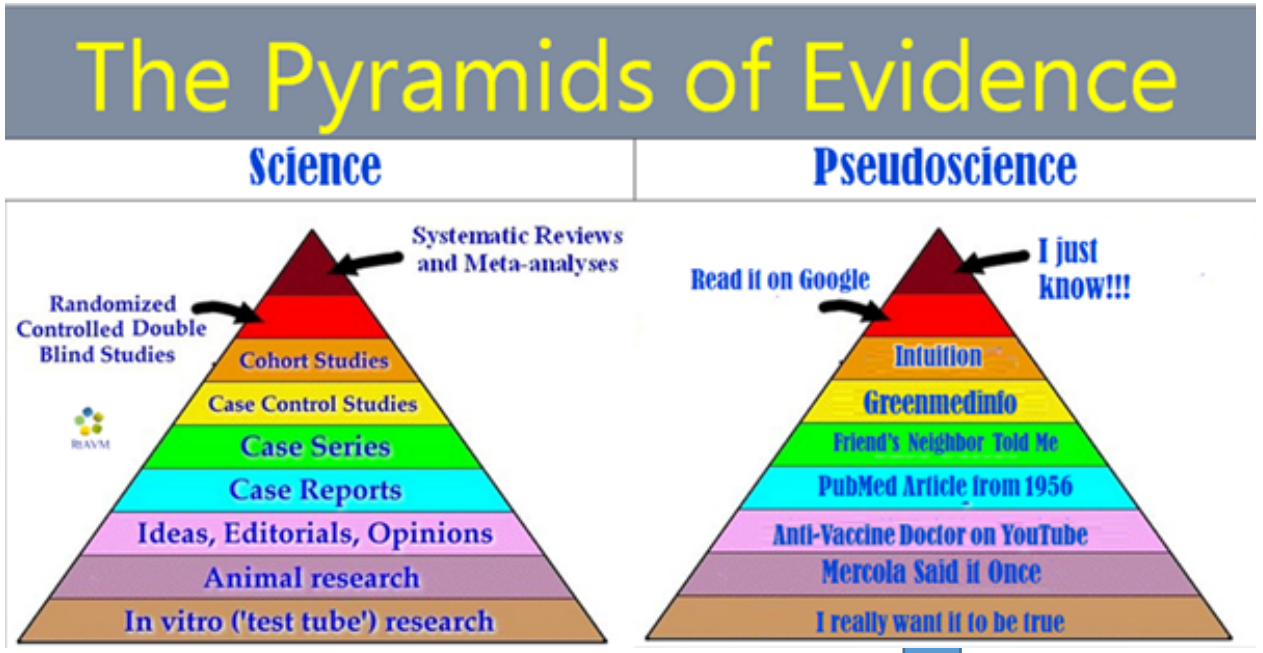
Social contagion processes

- The processes of opinion/ideas spreading and social contagion have acquired special relevance due to the spread of Internet [1-5]
- The proliferation of online social media such as Twitter, Instagram, Facebook or Youtube has also contributed to these processes [6-7]
- Sharing knowledge is positive (collective intelligence), but WHAT IF misinformed-wrong-false-stupid ideas spread? [8]

The problem: why some minority ideas/opinions on vaccination spread?

War between science vs pseudoscience





Some anti-vaccination reasons to say NO…

1. Pharmaceutical companies can't be trusted (ever)
2. ALL vaccines are loaded with chemicals and heavy metals
3. Vaccinated Children are the unhealthiest, most chronically sick children
4. Other countries are waking up to the dangers of vaccination
5. Numerous vaccines have already had problems/been removed from the market
6. You can always get vaccinated, but you can never undo vaccine effect

An example of misinformation…

Another large comparative study of vaccinated versus unvaccina… published in May 2017 unearthed similar findings (source).

the healthy home economist

Take an informal poll of the folks in your circle and see for yourself. Observation is a powerful tool, so put it to use. **The kids with the most health and behavior problems – allergies, asthma, ADHD, autism, coordination and other gross motor issues, and the list goes on – are the ones that are right on track with their vaccination schedule.**

It's not just physical illness that plagues vaccinated children either. **Research out of Yale and Penn State demonstrated a strong association between vaccination and mental illness in children.** 95,000 children were analyzed by the Department of Public Health Science at the Pennsylvania State University College of Medicine and Yale University. A strong association between children receiving vaccinations and then immediate development of brain-related autoimmune and inflammatory disorders: ADHD, OCD, anxiety, depression, bipolar, anorexia, and chronic tic disorder was found (source).

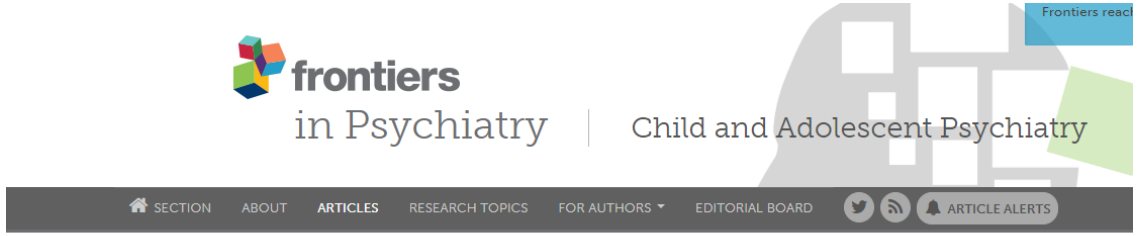
For compelling anecdotal evidence, ask Moms with several children, some of whom are vaccinated and some who are not, which of their children are the healthiest. In my own circle, the Moms I know who have one or two older kids who are fully vaccinated and the younger kids who did not get any shots tell me that, hands down, that the unvaccinated children are healthier and have less problems (usually none).

There is plenty of research available NOW for any open-minded, thinking parent to realize that vaccination of a child is a very bad idea. Throw out your preconceived ideas, read the science and realize the reality

In this example, the author includes the source of the study… and this is great!!

But what does the source exactly say? And who is the source (journal, research team…) of this controversial message?

The source of this information



Ok, we have a good journal (high IP, reliable…). This is good, so… maybe you should reject vaccination.

‹ Articles

ORIGINAL RESEARCH ARTICLE
Front. Psychiatry, 19 January 2017 | https://doi.org/10.3389/fpsyt.2017.00003

Temporal Association of Certain Neuropsychiatric Disorders Following Vaccination of Children and Adolescents: A Pilot Case–Control Study

Douglas L. Leslie[1]*, Robert A. Kobre[2], Brian J. Richmand[2], Selin Aktan Guloksuz[2] and James F. Leckman[2]*

[1]Department of Public Health Sciences, Pennsylvania State University College of Medicine, Hershey, PA, USA
[2]Yale Child Study Center, Yale University School of Medicine, New Haven, CT, USA

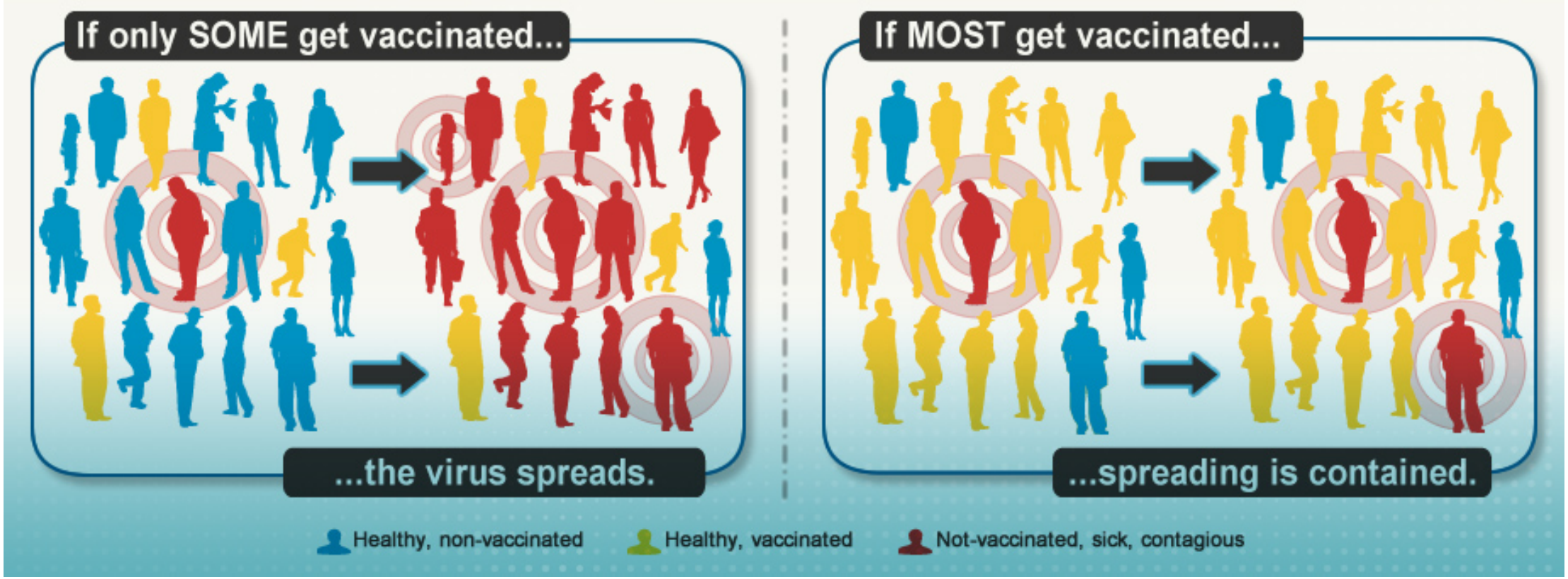
…, we compared the prior year's occurrence of vaccinations in children and adolescents aged 6–…psychiatric disorders that were newly diagnosed between January 2002 and December 2007, …ons, broken bones and open wounds. Subjects were matched with controls according to age, …d seasonality. Conditional logistic regression models were used to determine the association of …condition.

…y diagnosed AN were more likely than controls to have had any vaccination in the previous 3 …80, 95% confidence interval 1.21–2.68]. Influenza vaccinations during the prior 3, 6, and 12 … with incident diagnoses of AN, OCD, and an anxiety disorder. Several other associations were …ater than 1.40 (hepatitis A with OCD and AN; hepatitis B with AN; and meningitis with AN and …

Conclusion: This pilot epidemiologic analysis implies that the onset of some neuropsychiatric disorders may be temporally related to prior vaccinations in a subset of individuals. These findings warrant further investigation, but do not prove a causal role of antecedent infections or vaccinations in the pathoetiology of these conditions. Given the modest magnitude of these findings in contrast to the clear public health benefits of the timely administration of vaccines in preventing mortality and morbidity in childhood infectious diseases, we encourage families to maintain vaccination schedules according to CDC guidelines.

But wait!!! What does the authors say?

What does research evidence show?



Source: Center for Disease Control and Prevention

But the problem is that some people…

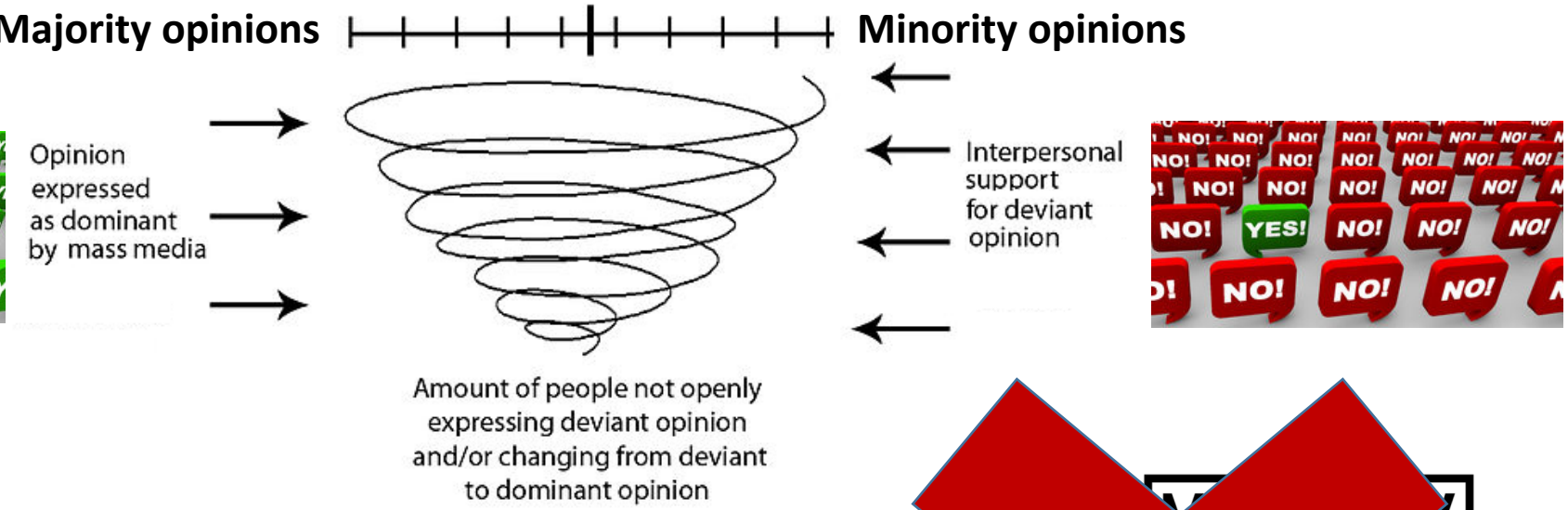
Then, how and why these (misinformed-wrong-false-stupid) minority opinions finally spread?

Multiple determinants of vaccination decision

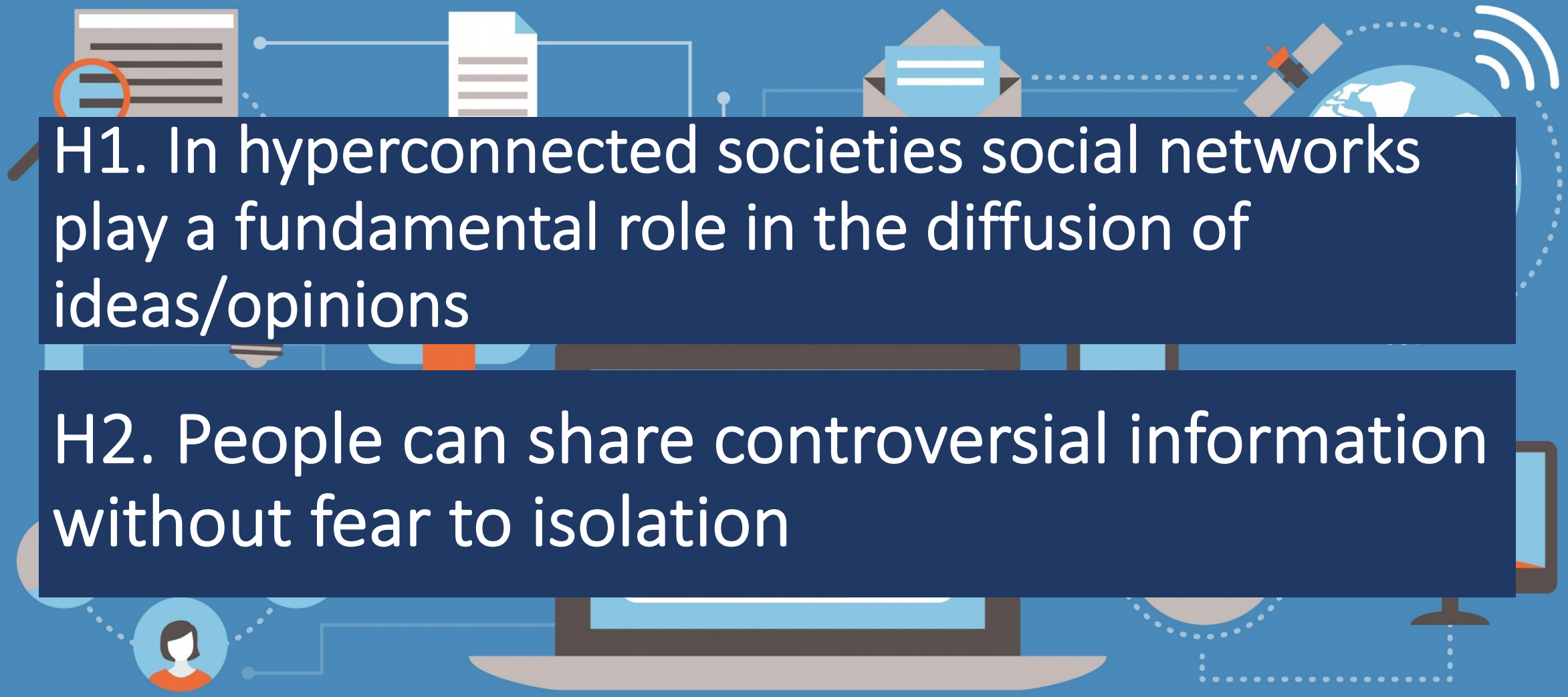
CONTEXTUAL INFLUENCES	INDIVIDUAL/SOCIAL GROUP INFLUENCES	VACCINE-SPECIFIC ISSUES
Socioeconomic context	Experience with past vaccinations	Cost (have to pay for vaccine?)
Culture, religion	Risk/benefits perceived	Novelty (new vaccine/formulation)
Health, educational, social policies	Personal experience with and trust in health system / provider	Vaccine-specific risk/benefits
Influential leaders (opinion leaders)	Knowledge and information we have	Vaccination schedule
Communication and media environment	Social norms, beliefs, attitudes, motivations about health and prevention	Mode of administration
Pharmaceutical industry	Socioeconomic status (SES)	Mode of delivery (e.g. campaings)
Historical influences	Socio-demographics (gender, age…)	Reliability of vaccine supply
Geographic barriers (access to healthcare)	Race/ethnicity	Role of healthcare professionals

These determinants can explain the behavior in some groups and context, but cannot define a general pattern/mechanism…

E. Noelle-Neumann's Spiral of Silence Theory



In theory, deviant ideas should be generally silenced since people have fear to social isolation. But this is not always the case...



H1. In hyperconnected societies social networks play a fundamental role in the diffusion of ideas/opinions

H2. People can share controversial information without fear to isolation

This work aims to pose three basic questions

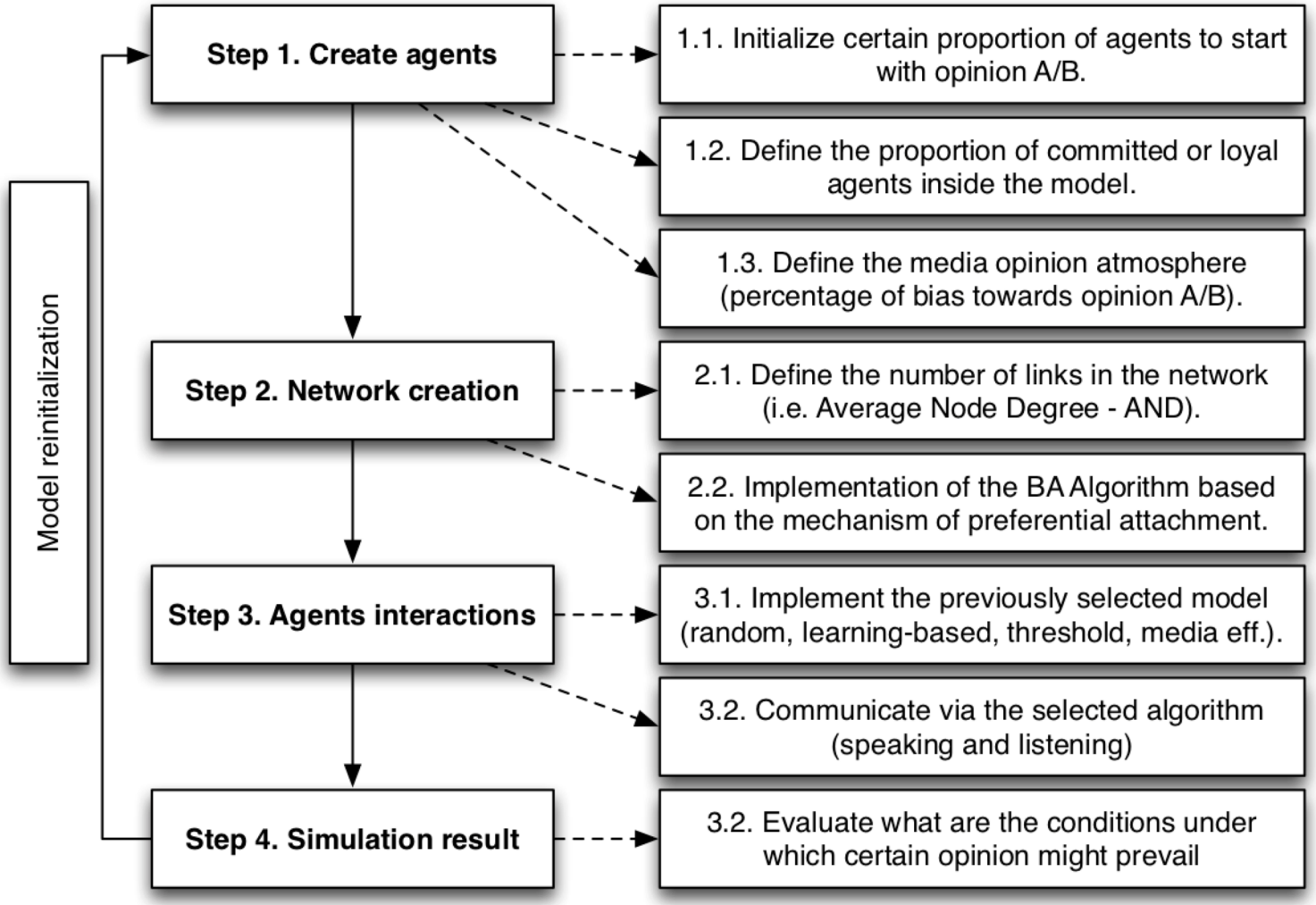
1. How the structure of social networks can affect the spread of minority opinion (structural effect)
2. How committed agents influence this process (individual effect) and
3. How mass media action, as a contextual factor, can vary different agents' opinions and network composition (contextual effect).[8]

Four simulated scenarios [8]

Scenario: Opinion type	Explanatory model	Phenomenon under study	Social agreement	Possible explanation
Scenario 1: Trivial opinion	**Random individual contagion**	Conformity, based on initial lack of information	Easy consensus, because there is no previous knowledge or argumentation	You choose one of your neighbors randomly, and adopt their opinions.
Scenario 2: Reasonable (or argued) opinion	**Learning (or reward)**	Social choice, based on different known alternatives	Intermediate (or neutral), depends on the arguments	Your opinion might change over time, if your neighbors have arguments to change your opinion and you are not committed to your previous opinion.
Scenario 3: Controversial micro (peer group)	**Preferential attachment**	Group polarization, based on private social desirability bias	Probable dissension and silencing behavior	Your opinion depends on your neighbors' opinion. In this case, your decision to change your opinion depends on the percentage of neighbors
Scenario 4: Controversial macro (Public Opinion)	**Preferential attachment and selective exposure**	Group polarization, based on public social desirability bias and external media sources	Probable dissension and massive silencing behavior	Your opinion depends on your neighbors' opinion, and also on (social) media information. In this case, your opinion depends on a dual climate of opinion

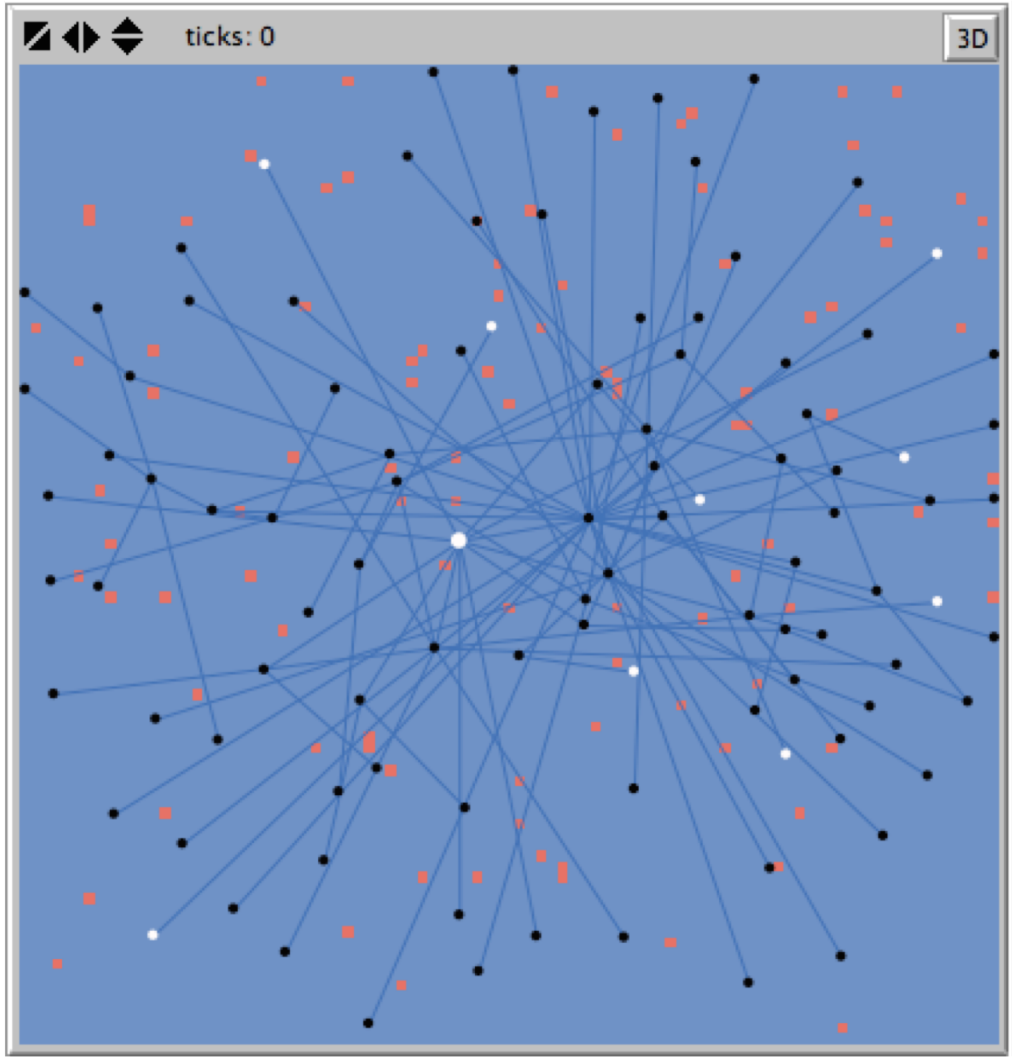
Steps in model implementation [8-9]

so, how does it work?

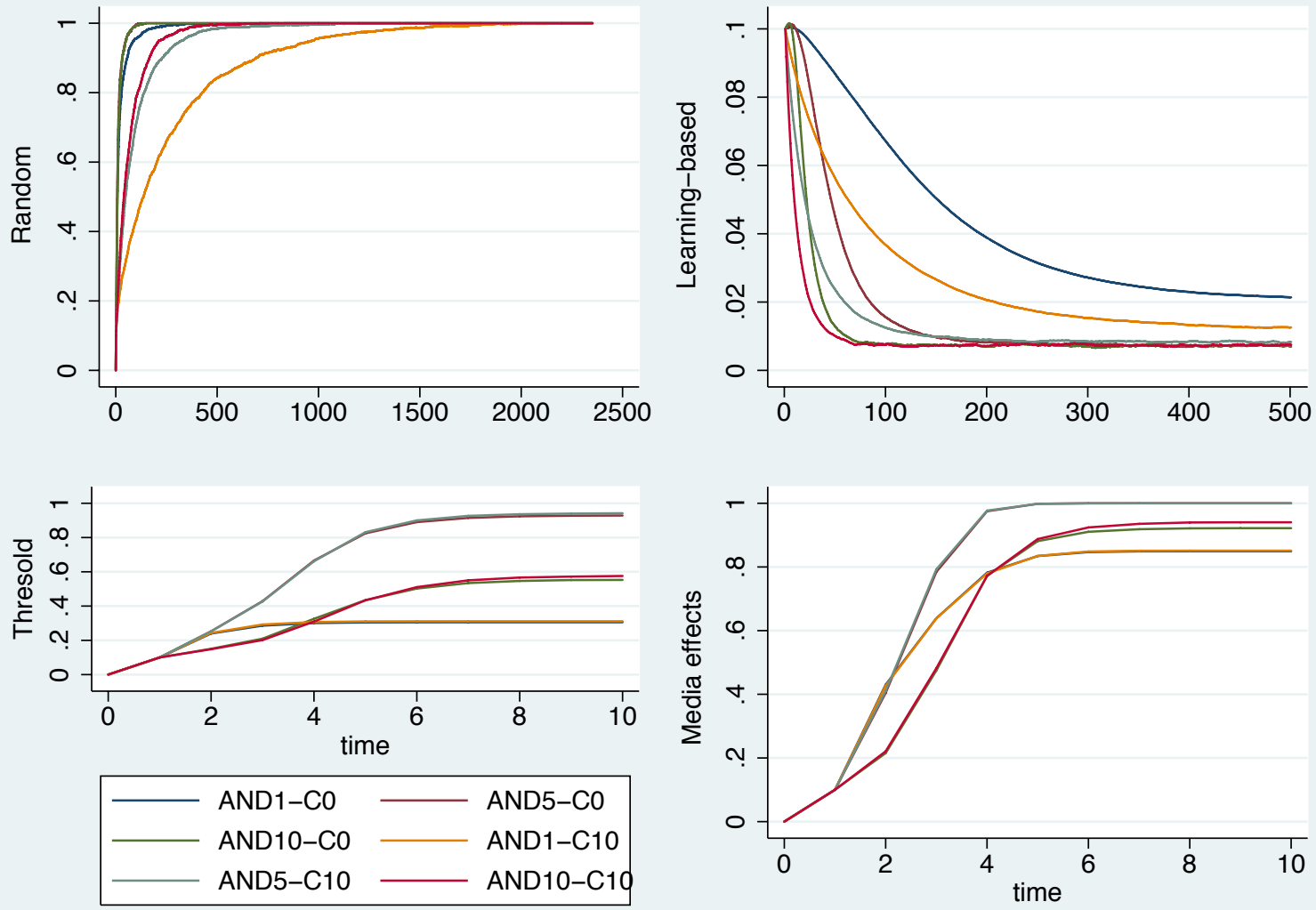


Model settings

- Network size = 100
- Percentage opinion B (minority) = 10%
- Average-node-degree (average connections in the network) = 2
- Committed agents = 10%



Analysis via scenarios



Main

But the problems is that in real life we also follow emotional content…

…inion could win the game if…

…e network structure sustain and spread

…bet…

…when e…

…(i.e. …edia increa…

…inter…ty)

4. Especially under combined situatio… of these processes and the difficult…

- The learning-based scenario is more resis… opinions.

Limitations & future orientations

1. **Limitations:**
   - Need to add specific determinants of vaccination behavior (vaccine-specific, SES, cultural…)
   - Need to explore the integration of emotions in these models (emotions vs knowledge to determine vaccination decision making)
2. **Future orientation:**
   - Help policy-makers to reduce (or eradicate) unhealthy or dangerous habits by the promotion of evidence-based knowledge
   - Design and implementation of new tools for decision support in public health

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